

Amendment 2
and Environmental Assessment

Fishery Management Plan for the
Precious Corals Fisheries of the Western Pacific Region

October 12, 1990

Western Pacific Regional Fishery Management Council
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CONTENTS

	page
LIST OF TABLES	iii
1.0 PREFACE	1
1.1 Responsible Agencies	1
1.2 Public Review and Comment	1
1.3 Relationship to Applicable Laws and Policies	2
1.4 List of Preparers	2
2.0 BACKGROUND	3
2.1 Biological Characteristics	4
2.2 Habitat	4
2.3 Distribution in the US EEZ	5
2.4 Description of Fishery	5
2.5 Vessel Safety Considerations	6
2.6 Condition of Stocks in the US EEZ around the Hawaiian Islands	6
3.0 EXISTING MANAGEMENT MEASURES	7
4.0 NEED FOR AMENDMENT 2	9
5.0 MANAGEMENT OBJECTIVES OF AMENDMENT 2	9
6.0 PROPOSED ACTIONS	9
6.1 List of Proposed Actions	9
6.2 Impacts of Proposed Actions	14
6.3 Location of Proposed Actions	15
6.4 Monitoring of Proposed Actions and Possible Council Responses	15
7.0 REJECTED ALTERNATIVES	15
7.1 List of Rejected Alternatives and Reason for Rejection	15
8.0 RELATIONSHIP OF AMENDMENT 2 TO OTHER APPLICABLE LAWS AND POLICIES	16
8.1 Coastal Zone Consistency	16

8.2	Marine Mammal Protection Act and Endangered Species Act .	16
8.3	National Environmental Policy Act - Environmental Assessment	17
8.4	Executive Order 12291 and Regulatory Flexibility Act	19
8.5	Paperwork Reduction Act	19
8.6	Indigenous Peoples' Fishing Rights	19
9.0	LITERATURE CITED	19

TABLES

		page
Table 1.	Survivorship, growth and yield of the precious pink coral, <u>Corallium secundum</u>	11

1.0 PREFACE

1.1 Responsible Agencies

The Western Pacific Regional Fishery Management Council (WPRFMC or Council) was established by the Magnuson Fishery Conservation and Management Act (MFCMA) to develop Fishery Management Plans (FMPs) for fisheries in the US Exclusive Economic Zone (EEZ) around American Samoa, Hawaii (including the Northwestern Hawaiian Islands), Guam, the Northern Mariana Islands, and other United States possessions in the Pacific¹. Once an FMP is approved by the Secretary of Commerce, it is implemented by federal regulations which, in turn, are enforced by the National Marine Fisheries Service (NMFS) and the US Coast Guard, along with state and territorial agencies.

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1.2 Public Review and Comment

The Council elicits the help of commercial and recreational fishing interests, as well as other interested parties. This ensures that those who might be affected by new management measures have an opportunity to submit ideas and suggestions for potential actions by the Council. Therefore, those affected by the FMPs are involved in the decision-making process.

The action proposed by this amendment was developed by the Precious Corals Plan Team, and was reviewed by the Scientific and Statistical Committee and the industry Advisory Panel. A draft of this amendment was distributed for comments to fishermen and other interested parties in August 1990. The final document is responsive to comments received, and the Council considered these comments at its September 1990 public meeting. The comments were

¹ *Howland and Baker Islands, Jarvis Island, Johnston Atoll, Kingman Reef and Palmyra Island, and Wake Island.*

incorporated into the draft amendment, which will be submitted to the Secretary of Commerce and released for public review.

1.3 Relationship to Applicable Laws and Policies

This second amendment to the FMP for the Precious Corals complies with the Secretary of Commerce's revised guidelines for the national standards of the MFCMA. Information and analysis in support of the proposed action are presented in a manner intended to satisfy MFCMA requirements, as well as the requirements of other applicable laws and policies. The FMP for the Precious Coral Fisheries for which the amendment is being prepared satisfies the information and procedural requirements of the National Environmental Policy Act, the Regulatory Flexibility Act, Executive Order 12291, and other laws and directives. The FMP also served as an Environmental Impact Statement (EIS). Similarly, this amendment is intended to serve as an Environmental Assessment. The amendment assesses the economic and administrative/enforcement impacts of the proposed actions, and will satisfy the requirement for a Regulatory Impact Review. This document contains all the information necessary under the several statutes and directives applicable to the planning process. A copy of the original FMP, its amendment, and companion regulations may be obtained from the Council. In addition, this amendment provides information regarding habitat and vessel safety concerns as required by the 1986 changes to the MFCMA.

1.4 List of Preparers

Amendment 2 for the Precious Corals FMP was prepared by the WPRFMC Precious Corals Plan Team:

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2.0 BACKGROUND

Harvesting of deep-water precious corals is subject to the regulations of the FMP (effective date: September 29, 1983), which covers domestic and foreign fishing for several species of precious pink, gold and bamboo corals² inhabiting the US EEZ of the Western Pacific Region (WPRFMC 1980, as amended).

The goal of the FMP is to obtain optimum yield from the fishery through several objectives:

- 1) prevent overfishing and waste of the resource;
- 2) minimize harvest of immature colonies;
- 3) minimize harvest of colonies that have not reached full growth;
- 4) preserve opportunities for low-cost equipment in the fishery (e.g., tangle-net dredges);
- 5) encourage discovery and exploration of new coral beds;
- 6) encourage development of new information on the ecology of precious corals.

² Pink corals (Corallium secundum, C. regale, C. laauense, C. spp.) ; gold corals (Gerardia spp., Callogorgia gilberti, Narella spp., Calyptraphora sp.); bamboo corals (Lepidisis olapa, Acanella spp.); the FMP also discusses, but does not manage, black corals (Antipathes dichotoma, A. grandis, A. ulex).

2.1 Biological Characteristics

These coral species are slow-growing and display low mortality and recruitment rates. Natural populations are relatively stable, and a wide range of age classes is generally present in the beds. This life-history pattern (longevity and multiple year classes) has two important consequences with respect to exploitation: (1) the response of the population to exploitation extends over many years, and (2) if a stock has been overexploited for several years, a long period of reduced fishing effort is required to restore the ability of the stock to provide coral at Maximum Sustainable Yield (MSY), because of the great longevity of individuals, and the associated slow rates of turnover in the populations.

2.2 Habitat

This section supports and is consistent with the NMFS Habitat Conservation Policy. The precious corals covered by the FMP live in deep water on solid substrate where bottom currents are frequently strong (Grigg 1974). Different species of precious corals inhabit distinct non-overlapping depth zones, but their habitat requirements are strikingly similar. Strong currents prevent the accumulation of sediments, which would keep new larvae from settling and smother young colonies. Currents also carry food to (and waste from) corals, but the full importance of strong currents to living colonies is unclear. Precious corals have been recorded growing on a variety of substrate types, but coral harvests tend to be highest on bottoms of limestone, shell-sandstone, and basaltic or metamorphic rock with a limestone veneer.

In federal waters, precious corals occur in two principal depth zones; 350-450 m and 1000-1500 m. In the Hawaiian Archipelago, these zones encompass 1700 nm² and 5900 nm² of potential habitat, respectively, and range from 18°N to 35°N. A variety of other invertebrates and fish are known to occur with precious corals. Species of possible commercial importance include a snapper (onaga, Etelis coruscans), the yellowtail (kahala, Seriola dumerilii), and the shrimp Heterocarpus ensifer. These species do not appear to depend on the coral for shelter or food. No threatened or endangered species is known to occur with precious corals in the western Pacific.

The habitat sustaining precious corals is generally in a pristine condition. There are no known areas that have sustained damage due to resource exploitation, notwithstanding the alleged heavy foreign fishing for corals in the Hancock Seamounts area. Although unlikely, if future development projects are planned in the proximity of precious coral beds, care should be taken to prevent damage to the beds. Projects of particular concern would be those that suspend

sediments or modify water-movement patterns. The Council has a standing committee on Ecosystems and Habitat that will advise the Council on potential threats to precious corals habitat, and will recommend steps to prevent or mitigate adverse impacts on the resource.

2.3 Distribution in the US EEZ

To date, beds of pink, gold or bamboo corals have been found at several locations in and around the Hawaiian Archipelago. Precious corals have been discovered in the EEZ around Palmyra, but the extent of this bed is not known. Very small beds of deep-water precious corals have recently been discovered on Cross Seamount (southwest of the island of Hawaii) and a bank east of French Frigate Shoals (in the middle of the Hawaiian Archipelago) but these beds appear too small for commercial harvests. Precious corals almost certainly occur within the EEZ around the territories of American Samoa and Guam, the Commonwealth of the Northern Mariana Islands (CNMI), and other US possessions in the Pacific, but virtually nothing is known of their distribution and abundance in these areas. Of the known beds in the Western Pacific Region, only the bed off Makapuu Pt., Oahu, Hawaii, has been reliably surveyed for commercial densities. The annual sustainable harvest from the six Hawaiian beds³ is estimated at approximately 3000 kg yr⁻¹ for all species combined.

2.4 Description of Fishery

Precious corals are important deep-water resources frequently found on offshore banks and seamounts. The resource and its fishery is global, but the richest beds are found on seamounts in the western Mediterranean Sea and the western North Pacific Ocean.

A. US EEZ

Domestic participation in precious corals harvesting began in 1966, when US scientists discovered a commercial bed of pink coral off Makapuu Point in the Molokai Channel. Shortly thereafter, a small group of fishermen began dredging this bed on a small scale. Research at the University of Hawaii led to the development of a selective harvesting system using a manned submersible. A Hawaii-based company adopted this system and began fishing the Makapuu Bed in 1973, but high operating costs ended the operation in 1979. In 1988 and 1989, one coral-dredging vessel operated out of Hawaii but limited success, including

³ 180-Fathom Bank, Brooks Bank, Kaena Pt., Keahole Pt., Makapuu and WesPac.

unsuccessful catches at and near Hancock Seamounts, forced it to leave the fishery.

B. International Waters

Precious corals fisheries have existed in the Mediterranean Sea since ancient times, but commercial beds of precious corals were not discovered in the Pacific until the early 1800s, off Japan. Until recent years, the Pacific precious corals fisheries were centered off Japan, Okinawa and Taiwan. The focus of the world harvest has shifted from those traditional grounds in the far western Pacific to the newly discovered grounds in the Emperor Seamounts. Because Midway is the nearest island to the Emperor Seamounts fishing grounds, corals dredged from this area have been labeled in the trade as "Midway" coral, and this coral has accounted for as much as 90% of the annual world production. Only about 10% of the "Midway" grounds lie within the US EEZ (near the Hancock Seamounts at the northwest limit of the EEZ), however, so most of the fishery is unregulated.

C. Foreign Harvest

The large harvests reported by foreign fishermen from the Milwaukee Banks of the Emperor Seamounts in the early 1980s are indicative of the harvest potential for precious corals in the US EEZ. Even though most precious coral resources are in international waters, foreign interest exists in US coral resources. Allegations of illegal foreign operations in the EEZ of the NWHI provide indirect evidence that additional productive beds exist. Foreign activity in the region has declined in recent years, however, which suggests that some of the once-productive beds are now over-exploited.

2.5 Vessel Safety Considerations

Vessel safety is not affected in this fishery because none of the actions proposed in the FMP or in this amendment impose any restrictions on vessel operations. Nonetheless, this amendment will be reviewed by the US Coast Guard for evaluation regarding vessel safety.

2.6 Condition of Stocks in the US EEZ around the Hawaiian Islands

The only regular, domestic commercial fishery for precious corals existed in the Makapuu Bed for six years during the 1970s. During this period about 17,500 kg of pink coral was collected (Grigg 1988). This represents about 40% (by weight) of the estimated standing crop of pink coral in the entire bed.

Transect surveys of the Makapuu Bed were conducted with a manned submersible in 1971, early 1983 and late 1985. The first survey was conducted before any commercial harvesting had taken place. The other two surveys were completed about three and six years after harvesting had ceased. The surveys indicated that harvesting had no apparent effect on coral recruitment rates. The combined mean density for all megafaunal species of precious coral in the Makapuu Bed did not change significantly between 1971 and 1985, and is approximately 0.1 colonies per square meter (Grigg 1988). The low densities indicate that space is not a limiting factor for megafaunal populations in the Makapuu Bed. Furthermore, there is little indication of age-specific differences in natural mortality.

The age-frequency distributions observed in the 1983 and 1985 surveys, when compared to the age-frequency distribution of the virgin population in 1971, provide a measure of impact caused by harvesting, as well as a measure of the ability for precious coral resources to recover from fishing pressure. By comparing the 1985 and 1971 age-frequency distributions of pink coral it is predicted that full recovery of the Makapuu Bed to the virgin state may require up to 25 years. Recovery is apparently a simple function of slow growth gradually in-filling year classes that were removed by harvesting. At the Makapuu Bed, recruitment appears unaffected by harvesting and is independent of the density of the standing stock. In short, recruitment in the Makapuu Bed may be wholly dependent on outside sources. The Makapuu Bed appears to be healthy enough to once again sustain a small domestic harvest quota.

Nothing is known about the status of the precious coral resources in the Exploratory Areas or the precise location where foreign draggers have allegedly poached large quantities of precious corals in the EEZ of the NWHI. With the exception of the Makapuu Bed and those beds harvested illegally by foreign fishermen, all other precious coral beds within the US EEZ are believed to be in an unexploited or "virgin" state.

3.0 EXISTING MANAGEMENT MEASURES

In the FMP, precious corals beds are treated as distinct management units because of their widely-separated patchy distribution and the sessile nature of individual colonies, even though recruitment may be dependent on reproduction at other coral beds. The four categories are Established Bed, Conditional Bed, Refugia Bed and Exploratory Permit Area.

- A. Established Beds are ones for which appraisals of maximum sustainable yields are reasonably precise. To date, only the Makapuu Bed has been studied well enough to be classified as

Established. Both the State of Hawaii and the WPRFMC have management measures in place at the Makapuu Bed.

- B. Conditional Beds are beds for which only an estimate of MSY exists, based on the approximate size of the bed rather than on survey or fishery performance data. The ecological conditions at the Makapuu Bed are assumed to be representative of conditions at the Conditional Beds. MSY estimates for Conditional Beds are then calculated by assigning the Makapuu Bed MSY, factored by the relative size of the Conditional Bed to the Makapuu Bed. Four beds of precious corals are classified as Conditional (180-Fathom Bank, Brooks Bank, Kaena Pt., Keahole Pt.), all of them around the Hawaiian Islands.
- C. Refugia Beds are areas set aside for baseline studies and possible reproductive reserves. No harvesting of any type is allowed in these areas. To date, the only refuge is the Wespac Bed (between Nihoa and Necker Islands in the Hawaiian Archipelago).
- D. Exploratory Permit Areas are the unexplored portions of the EEZ. There are four such areas: around American Samoa, Guam, Hawaii and US island possessions.

The regulations prescribe methods of harvest for each class of coral bed and harvest quotas for individual beds. Only selective gear is permitted in the EEZ around the main Hawaiian Islands, i.e., east of a north-south imaginary line midway between Niihau and Nihoa Islands. The use of selective and non-selective gear is permitted at the NWHI Conditional Beds of Brooks Bank and the 180-Fathom Bank, and throughout the Exploratory Permit Area of the NWHI. Quotas have been established for pink, gold and bamboo coral populations in the Makapuu Bed and Conditional Beds. If tangle-net dredges are employed on Conditional Beds, the weight quota is only 20% of that allowed for selective harvesters because tangle-net dredges kill up to an additional 150% of the colonies that would have been harvested selectively (Grigg 1989). Domestic or foreign fishing in each Exploratory Permit Areas may harvest up to 1000 kg of all species combined per area per year. In addition to regulating harvesting methods and harvest amounts, the FMP establishes a procedure for upgrading coral beds from Exploratory to Conditional to Established as new beds are located and more catch/effort data become available that allow more accurate determinations of sustainable yields.

Amendment 1 to the FMP: (1) conferred the management measures of the FMP to all US island possessions in the Pacific by incorporating them into a single Exploratory Permit Area, (2) expanded the managed species to include the

Midway Deep-sea coral, Corallium sp. nov., and (3) outlined provisions for Experimental Fishing Permits that were designed to stimulate the domestic fishery and gather information on unexplored beds by approving quotas for Exploratory Permit Areas that are larger than the normal 1000-kg limit.

4.0 NEED FOR AMENDMENT 2

The MFCMA does not define overfishing, nor does the precious corals FMP. In addition, biological data necessary to determine overfishing are limited, so management decisions might be made without sufficient regard to the long-term health of the resource or industry. To ensure that long-term viability is a basic consideration, the Secretary's revised guidelines (Federal Register: 54 FR 30826) stipulate that:

- A. each FMP specify an objective and measurable definition of overfishing for each stock or stock complex, with an analysis of how the definition was developed and how it relates to biological potential, and
- B. a Stock Assessment and Fishery Evaluation (SAFE) report, or its equivalent, be prepared and updated as necessary. The report would summarize the best biological, economic, social and ecological information about the stocks being managed.

5.0 MANAGEMENT OBJECTIVES OF AMENDMENT 2

The management objectives of Amendment 2 are to:

- A. help ensure the long-term health of the precious corals resources by specifying what portion of the spawning stock biomass must be protected in order to maintain the productive capacity of the species being managed under the FMP.
- B. help ensure the timely detection of changes and initiation of appropriate management action by the Council through periodic monitoring and assessment of the coral stocks and coral fishing in the EEZ.

6.0 PROPOSED ACTIONS

6.1 List of Proposed Actions

The actions of Amendment 2 to the Precious Corals FMP are to:

A. Define overfishing as follows:

"An Established coral bed shall be deemed overfished with respect to recruitment when the total spawning biomass (all species combined) has been reduced to 20% of its unfished condition."

This definition applies to all species of precious corals, and is based on cohort analyses of the pink coral, Corallium secundum. It takes into account the mean survivorship, yield, age at maturity, reproductive potential and MSY of the coral populations (see Table 1). It is also based on conservative estimates of harvest yields necessary to protect the spawning stock biomass of precious corals, and is consistent with language already in the FMP.

Table 1. Survivorship, growth and yield of the precious pink coral, Corallium secundum.

Age Group (yr) (a)	Mean Survivorship (b)	Mean Weight (g) (c)	Mean Yield (g) (b X c)	% Spawning Stock Biomass
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Sublegal Size:

0-5*	.87	6.4	5.6	
5-10*	.64	77.5	49.6	
10-15*	.48	247.2	118.6	
15-20	.35	530.6	185.7	
20-25	.26	938.7	243.8	

***** OVERFISHING *****

25-30	.19	1480	281.2	
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***** MSY *****

Legal Size:

30-35	.14	2163	302.8	
35-40	.11	2993	329.2	
40-45	.08	3976	318.1	
45-50	.06	5118	307.0	
50-55	.04	6428	256.0	
55-60	.03	7898	236.0	

* sexually-immature colonies

The model shows that 71.1% of the sexually-mature colonies are made up of legal-sized colonies, as defined in the FMP. That is, approximately 70% of the spawning stock biomass is older than 30 years, which is the age at which MSY is achieved. This is the level at which current management efforts such as minimum size limits, quotas, etc., are focused. Additional or different management measures would be mandatory if the spawning stock were reduced an additional 10%; this level would constitute overfishing.

Sustainable yield was assessed by modeling the pink coral resource using empirically-derived estimates of age-class structure, growth, and mortality along with hypothesized stock recruitment relationships. MSY was found to equal about 1200 kg at an age of first harvest of 30 yr for a constant recruitment model. Estimated MSY drops, however, to about 1000 kg for more realistic stock recruitment models where recruitment falls off gradually with declining stock until low stock levels where it declines precipitously. Hence, the Council selected a more realistic estimate of 1000 kg at age 30 (Figure 15 in the FMP) as its definition of MSY. Pulse fishing is allowed under the FMP to harvest the resource down to the age at first entry into the fishery that would result in MSY. From Table 1, this harvesting strategy can be seen to result in a spawning potential ratio ($SPR = \text{spawning stock biomass}_{\text{fished}} / \text{spawning stock biomass}_{\text{unfished}}$) equal to approximately 30% (or the removal of 70% of the spawning stock biomass). Surveys of the Makapuu Bed conducted toward the end of the pulse fishing period and after approximately 10 years of unfished recovery, indicated that recruitment into the fishable portion of the stock had occurred as expected based on the growth model. However, sufficient time had not elapsed to verify whether recruitment due to settlement as opposed to recruitment due to growth of previous settlement had been effected by the MSY-pulse harvesting rate.

If pulse fishing were to harvest down through age 25, SPR would equal 17% and protect 10 out of 45 age-classes of spawning animals. Since managing at MSY with pulse fishing is estimated to result in protecting 30% of the spawning stock biomass for this resource, the Precious Corals Plan Team concluded that protecting 20% (or 12-13 age-classes) is a reasonably prudent threshold for preventing overfishing. Availability of research funds to conduct surveys to verify settlement and subsequent recruitment by growth into the fishable portion of the stock will make it possible to verify the adequacy of the model and the efficacy of the management strategy chosen.

It should be pointed out that, according to the model, harvesting down through age 20 results in a SPR of only 8% and protects only 5 out of the original 45 mature age-classes. Maximum yield per recruit (Y/R, Fig. 13 in the FMP) is obtained at about age 20 for age of first harvest. While managing at Y/R is generally regarded as less conservative than managing at MSY, the Plan Team, SSC and Council concluded that it would not be prudent to set the overfishing threshold at this level because too few mature size classes are protected given the uncertainty involving the stock-recruitment relationship.

The biological parameters used in the cohort analysis for C. secundum will be applied to other precious coral species. The overfishing definition will be applied to other species, at least until adequate basic information is gained about the other species.

- B. Require an annual report which summarizes the best scientific information available on the biological condition of established precious coral beds within the US EEZ of the Western Pacific Region, and on the fisheries being managed under the FMP.

The Council staff and the Precious Corals Plan Team (Team) will have lead responsibility for preparing an annual report on the previous year's harvest levels of precious corals, significant trends in the fishery, and the effectiveness of the plan in meeting its objectives. The Council staff and Team will work closely with the NMFS, Coast Guard, and state and territory officials to ensure that data submission requirements and data collection programs are generating the information necessary for effectively monitoring the fishery and determining whether different or alternative management measures are necessary. As conditions in the fishery dictate, the NMFS Honolulu Laboratory will provide timely data analyses and research results on the precious corals fishery for use by the Council staff and Team.

The Team will prepare for the Council an annual report on the fishery, relative to the prevention of overfishing as defined in the FMP, by March 31 each year. The report will contain an overview of the status of precious coral stocks and any significant trends in the fishery. Information for the previous year will be compared with prior years, to the extent data are available for each area of the EEZ and adjacent waters of the Region. The report should contain at least the following information, if such information is new or has changed since the previous year's report:

- 1) Stock Assessment
 - a. Estimates of total biomass and spawning biomass for each established coral bed;
 - b. Comparison of those estimates to the biomass estimates from previous years;
 - c. Explanation of how those estimates were calculated and their reliability;
 - d. If a bed is overfished, estimated time necessary for the spawning stock biomass to recover to a level at which the

stock's reproductive capacity is maintained (and fishing can resume).

- 2) Fishery Performance Data
 - a. Estimated amount of precious coral harvested by species, size, gear type and area;
 - b. Approximate ex-vessel revenue of harvested coral by species;
 - c. Estimated amount and volume of the processed product derived from harvested raw material;
 - d. Number of vessels by gear type, number of trips, days fished, landings per trip, and other indicators of performance.
- 3) Summary of Recent Research and Survey Results
- 4) Habitat Conditions and Recent Alterations
- 5) Enforcement Activities and Problems
- 6) Administrative Actions (e.g., data collection, reporting, permits)
- 7) State and Territory Management Actions
- 8) Assessment of Need for Council Action:
 - a. Biological conditions and trends
 - b. Economic conditions and trends
 - c. Social conditions and trends
 - d. Enforcement issues
 - e. Administrative issues
 - f. State/federal consistency
- 9) Recommendations for Council Action
- 10) Estimated Impacts of Recommended Action

6.2 Impacts of Proposed Actions

- A. The overfishing definition would provide an objective and measurable definition of overfishing for the Western Pacific Region's precious corals stocks in areas where enough data exist (i.e., Established Beds). There would be no impact on other classes of beds; other beds would need to be studied sufficiently to upgrade them to Established Beds before the overfishing definition could be applied. Ultimately, all precious corals beds will be classified as Established, so all beds will be protected from overfishing.
- B. The annual report would help ensure the timely detection of changes in the corals fishery by periodic monitoring and assessment of the fishery in the EEZ, thus satisfying any requirement for a SAFE document.

6.3 Location of Proposed Actions

The proposed actions apply to all areas of the EEZ under jurisdiction of the Council (except the CNMI), i.e., American Samoa, Guam, Hawaii (including the Northwestern Hawaiian Islands), and other US possessions in the Pacific.

6.4 Monitoring of Proposed Actions and Possible Council Responses

The FMP already contains provisions for scientific observers and mandatory catch reporting. These provisions allow constant monitoring, and provide the vehicle for classifying newly-discovered beds, as well as monitoring Established Beds.

The new requirement for an annual report will explicitly identify any established bed which has been overfished as defined in this amendment. If a bed is found to be overfished, the report will evaluate potential corrective measures for Council adoption, including such potential measures as immediate bed closure(s), lower quotas to achieve rebuilding, a change in size limits, or other actions.

The Council will then review the analysis and determine which specific measures should be implemented to ensure rebuilding of coral stocks on an overfished bed to at least the threshold level within 15 years. The Council's proposed measures will be presented to the Regional Director within 30 days of the meeting at which the decision is made. If the Regional Director approves, the proposed measures will be implemented through a change in the regulations implementing the FMP.

7.0 REJECTED ALTERNATIVES

7.1 List of Rejected Alternatives and Reason for Rejection

A. No action.

A no action alternative maintains the status quo in which an overfishing definition is not specified in the FMP and a periodic report assessing the condition of the stock (or stock complex) or condition of the fisheries is not required. This alternative is not in accord with the revised national standards guidelines, so it was rejected.

B. Alternative definition of overfishing:

"An Established coral bed shall be deemed overfished when the spawning stock biomass has been reduced to 30% of its virgin state."